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Title : Global maritime distress and safety system (GMDSS) Part 13: Inmarsat F77 ship earth station equipment - Operational and performance requirements, methods of testing and required test results.

Note d'introduction**Introductory note**

This new part of IEC 61097 specifies the minimum operational and performance requirements, technical characteristics, methods of testing and required test results for Inmarsat-F₇₇ ship earth stations (SES), capable of transmitting and receiving distress and safety communications using telephony, as required by Regulation IV / 10.1 and 14.1 of the 1988 amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS), for use in the GMDSS.

This document is circulated as an English CDV only.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)

**Part: 13 Inmarsat-F₇₇ ship earth station equipment
- operational and performance requirements,
methods of testing and required test results**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a world wide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61097-13 has been prepared by IEC technical committee 80:

The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until _____. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)

Part: 13 Inmarsat-F₇₇ ship earth station equipment - operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61097 specifies the minimum operational and performance requirements, technical characteristics, methods of testing and required test results for Inmarsat-F₇₇ ship earth stations (SES), capable of transmitting and receiving distress and safety communications using telephony, as required by Regulation IV / 10.1 and 14.1 of the 1988 amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS), for use in the GMDSS.

NOTE:- In order to meet the GMDSS carriage requirements of SOLAS in respect of receipt of SafetyNET broadcasts and direct printing telegraphy, it is necessary to install a combined Inmarsat-C/EGC transceiver in addition to the Inmarsat-F₇₇ equipment. Annex B provides more information.

This standard takes account of IMO Resolution A.694(17) - General requirements for ship-borne radio equipment forming part of the Global Maritime Distress and Safety System and for electronic navigational aids - and to which is associated IEC 60945 - Maritime navigation and radio-communication equipment and systems - General requirements - Methods of testing and required test results. When a requirement in this standard is different from IEC 60945, the requirement in this standard shall take precedence.

This standard incorporates the performance standards of the IMO Resolution A.808(19) as amended by MSC 75, Performance Standards for Inmarsat Ship Earth Stations capable of two way communications. It also incorporates the relevant ITU Radio Regulations.

All text of this standard, whose wording is identical to that in the IMO SOLAS Convention 1974 as amended, IMO Resolutions and IMO MSC circular 862, is printed in *italics* and the Resolution or Recommendation and paragraph number indicated between brackets.

It is a requirement of Inmarsat Ltd that all Inmarsat-F₇₇ mobile earth station models be type approved by Inmarsat before they can be allowed access to the Inmarsat space segment. This testing is designed to demonstrate that the equipment under test will be compatible with the Inmarsat-F₇₇ system and will not cause interference to other satellite users. It is recommended that approval authorities accept testing organised and supervised by Inmarsat, which results in Inmarsat type approval, without additional testing other than that defined in this document.

It is also recommended that equipment manufacturers rationalise the test requirements of this document and those of Inmarsat before embarking on the approval process.

NOTE:- This standard does not incorporate the Inmarsat system requirements needed for Inmarsat type approval. For these the latest edition of "Inmarsat mini-M SDM Change Note Number 65" should be consulted. When a requirement in this standard is different from one in the above mentioned Inmarsat document, reference shall be made to the most recent IMO and ITU applicable documents to resolve the difficulty.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC Publication IEC 60945: *Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results.*

IMO International Convention on Safety of Life at Sea (SOLAS) 1974, as amended.

IMO Resolution A.694 (17) - General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids.

IMO Resolution A808(19) - Performance standards for Inmarsat ship earth stations capable of two-way communications. As amended at COMSAR 6 and forwarded to MSC 75 for adoption

Note: During the voting stage of the CDV the amended text of A808 will be used with the original numbering

IMO MSC Circular 862 – Clarifications of certain requirements in IMO performance standards for GMDSS Equipment.

Inmarsat mini-M SDM change note No 65 (available on application to Inmarsat Ltd)

ITU Radio Regulations.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1.1

carrier to noise density ratio

the ratio of unmodulated carrier power to noise power normalised to a 1 Hz bandwidth

3.1.2

Inmarsat priorities

priority 3 = distress

priority 2 = urgency

priority 1 = safety

priority 0 = routine

3.1.3

L-band

is the frequency band in the range 1.4 GHz to 1.7 GHz allocated to the mobile satellite service and in which the EUT transmits and receives.

3.1.5

necessary bandwidth

for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

3.1.6

out-of-band emission

emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

3.1.7 performance check

In this standard, a “performance check” for the purpose defined in IEC 60945, shall comprise standard tests A and B

3.1.8 performance test

a “performance test” for the purpose defined in IEC 60945, shall comprise standard tests A and B, carried out for both distress and safety priorities.

3.1.9 physical layer test-set (PLT)

an item of test equipment designed to simulate the combined operation of an Inmarsat satellite and an Inmarsat-F₇₇ Land Earth Station. The PLT interfaces to the EUT at L-band, either by means of a small antenna or via coaxial cable. It permits voice calls to be set up in accordance with the relevant Inmarsat-F₇₇ protocols.

3.1.10 pre-emption

the automatic clearance of an ongoing call to enable a call of higher priority to be established.

3.1.11 SafetyNET

a service provided over a dedicated Inmarsat-C carrier, for the dissemination of maritime safety information, such as distress alerts, weather forecasts and coastal warnings.

3.1.12 spurious emissions

emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

3.1.13 standard tests

these are two tests defined in this document as Test A- Duplex Telephone Test (ship originated) and Test B – Duplex Telephone Test (shore originated) which together form the performance test required by IEC 60945.

3.1.14 unwanted emissions

consist of spurious emissions and out-of-band emissions.

3.2 Abbreviations

ACSE	Access control and signalling equipment
BER	Bit error rate
BPSK	Binary phase shift keying
C/No	Carrier to noise density ratio in 1Hz bandwidth.
EGC	Enhanced group call
EIRP	Effective isotropic radiated power
EMC	Electromagnetic compatibility
EUT	Equipment under test

GMDSS	Global maritime distress and safety system
G/T	Satellite receiver “Figure of Merit”
HPA	High Power Amplifier
ID	Identity
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
Inmarsat	Inmarsat Ltd.
ISO	International Organization for Standardization
ITU	International Telecommunications Union
LES	Land earth station
LESP	Land earth station packet data channel
MES	Mobile earth station
MESP	Mobile earth station packet data channel
MPDS	Inmarsat’s mobile packet data service (e.g. Internet access)
MSI	Maritime safety information
16-QAM	Quaternary amplitude modulation (16 state)
O-QPSK	Offset quaternary phase shift keying
PLT	Physical layer test-set
RCC	Rescue co-ordination centre
SDM	System definition manual (published by Inmarsat)
SES	Ship earth station
SOLAS	International convention for the safety of life at sea

4 General and operational requirements

This clause 4 includes the requirements taken from IMO SOLAS and IMO Resolutions A.808(19) and A.694(17) for which no repeatable or verifiable test can be specified or for which the test is limited to the verification of documentation presented by the manufacturer. It contains all operational tests, particularly those involving subjective judgement and which shall be conducted by personnel approved by national administrations. Some of the requirements listed in this clause are in addition to the relevant operational requirements of IEC 60945, which are also applicable.

4.1 General requirements

4.1.1 Definition

(SOLAS IV/10.1.1) *An INMARSAT F₇₇ ship earth station* which is defined in the “Inmarsat mini-M SDM Change Note Number 65” shall be *capable of*:

- .1 *transmitting and receiving distress and safety communications;*
- .2 *initiating and receiving distress priority calls;*
- .4 *transmitting and receiving general radio communications, using radiotelephony.*

4.1.2 Inmarsat type approval

(A.808/A.2) *The equipment shall be type approved by Inmarsat and shall comply with the environmental conditions specified in its technical requirements for Inmarsat ship earth stations capable of two-way communications.* Inmarsat type approval is required for access to

the Inmarsat space segment and is essential before approvals can be granted by national administrations.

4.1.3 Ship earth station installation requirements

(A.808/A.1) *The ship earth station installation (which will normally comprise an Inmarsat-F₇₇ transceiver and an additional Inmarsat-C/EGC transceiver) capable of telephony and data communications shall comply with the applicable general requirements set out in IMO resolution A.694(17) as detailed in IEC 60945.*

4.2 Operational requirements for Inmarsat F₇₇ SES

4.2.1 Prevention of alteration of ship earth station identity

(A.808/A.3.1) *No control external to the equipment shall be available for alteration of the ship earth station identity.*

4.2.2 Initiation of distress calls

(A.808/A.3.2) *It shall be possible to initiate and make distress calls by telephony or data communications from the position at which the ship is normally navigated and from any position designated for distress alerting. In addition, where a room is provided for radio communications, means to initiate distress calls shall also be fitted in that room. A suitable interface on the EUT to enable these two requirements to be achieved shall be provided by the equipment manufacturer.*

4.2.3 Dedicated distress button

4.2.3.1 Distress activation

(A.808/A.3.5) *A distress call shall be activated only by means of a dedicated distress button. This button shall not be any key of an ITU-T digital input panel or an ISO keyboard provided on the equipment.*

(A.808/A.3.4) *It shall be possible to interrupt and initiate distress calls at any time.*

(A.808/A.3.6) *The dedicated button shall:*

- .1 be clearly identified; and*
- .2 be protected against inadvertent operation.*

(A.808/A.3.7) *The distress call initiation shall require at least two independent actions.*

4.2.3.2 Clarification (MSC Circular 862)

MSC Circular 862 provides the following clarifications by IMO:

“DEDICATED DISTRESS BUTTON” – This button should not be any key of an ITU-T input panel or an ISO keyboard associated with the equipment and should be physically separated from functional buttons/keys used for normal operation. This button should be a single button for no other purpose than to initiate a distress alert.

“CLEARLY IDENTIFIED” – The distress button should be red in colour and marked “DISTRESS”. Where a non-transparent protective lid or cover is used, it should also be marked “DISTRESS”.

“PROTECTED AGAINST INADVERTENT ACTIVATION” – The required protection of the distress button should consist of a spring-loaded lid or cover permanently attached to the

equipment e.g., hinges. It should not be necessary for the user to remove additional seals or to break the lid or cover in order to operate the distress button.

The operation of the distress button should generate a visible and audible indication. The distress button should be kept pressed for at least 3 seconds. A flashing light and an intermittent acoustic signal should start immediately. After 3 seconds the transmission of the distress alert is initiated, the visible indication shall become steady and the acoustic indication shall cease.

Note: Inmarsat F 1 Service definition provides the following clarification. The MES shall ensure that selection of Maritime Distress priority shall not become effective until the switch contacts have been continuously held closed for a period of at least 5.0s

“AT LEAST TWO INDEPENDENT ACTIONS” – Lifting of the protective lid or cover is considered as the first action. Pressing the distress button as specified above is considered the second independent action.

4.2.3.3 Indications of distress call initiation

Audible and visible indications shall be made at all positions from where a distress call may be initiated, irrespective of the telephone terminal from which the distress call is originated. The visible indications shall continue until reset manually. This reset facility shall only be available to authorised personnel. It shall be possible to initiate further distress calls without re-setting the first indication. During performance testing with distress priority, indications shall be identical to those generated by initiation of a real distress call.

4.2.4 Alarm on reception of shore-originated duplex calls with distress priority

(A.808/A.3.3) Where no other means of receiving distress, urgency and safety broadcasts or an additional distress alert relay are provided and existing levels of aural signals produced by the telephone or printer are considered to be inadequate, the ship earth station equipment shall provide an aural/visual alarm of appropriate level. An output shall be provided to actuate an external aural/visual alarm on the receipt of a distress priority duplex call. (Distress, urgency and safety broadcasts are received by associated Inmarsat-C/EGC receiving equipment – annex B refers)

4.2.5 Radio frequency hazards

(A.808/A.4) In order to permit warnings of potential hazards to be displayed in appropriate places, a label shall be attached to the radome by the equipment manufacturer, indicating the distance at which radiation levels of 100W/m^2 , 25W/m^2 and 10W/m^2 exist.

The label shall have characters at least 20 mm high and be clearly readable in the normally installed position from a distance of at least 5 m. The maximum distance from the EUT at which the power density level of 100W/m^2 has been measured by the equipment manufacturer shall be included in the equipment manual. The power density at this distance shall be re-measured and the level specified in the equipment manual and on the label confirmed. The readability of the label at a distance of 5 m shall also be confirmed.

4.2.6 Safety precautions

The EUT shall satisfy the requirements for safety as stated in IMO resolution A.694(17) and detailed in IEC 60945. (A.694/A.7)

4.2.7 Equipment manual

The manual shall comply with the requirements of IEC 60945 as applicable

The manual shall contain information for the installation to comply with IMO requirements as detailed in annex A.

The manual shall also address the issue of reception of maritime safety information (MSI). (See annex B)

The manual shall also include a cautionary note to the effect that, before clearance of a distress priority call is initiated, the RCC must be advised as to why the call is being cleared.

The manual shall include the maximum distance from the radome at which a power density of 100W/m^2 has been measured by the manufacturer of the EUT.

4.2.8 Marking and identification

Marking and identification shall comply with the requirements of IEC 60945 as applicable and with the special requirements of 4.2.6 above

4.2.9 Maintenance

The EUT shall comply with the maintenance requirements of IEC 60945 as applicable

5 Technical requirements

This clause 5 includes all IMO/ITU requirements not covered by the Inmarsat mini-M SDM Change Note 65 and for which a repeatable method of measurement has been specified. The related test methods and required test results can be found in clause 6.

The equipment shall, in addition to meeting the requirements of the Radio Regulations, the relevant ITU Recommendations, the relevant Inmarsat technical requirements (Inmarsat mini-M SDM Change Note 65) and the general requirements set out in IMO resolution A.694(17), as detailed in IEC 60945, comply with the requirements of this standard.

5.1 Pre-emption by distress calls (ship originated)

On initiation of a distress priority call the EUT shall interrupt any on-going call of lower priority, if necessary, and then set up the distress priority call automatically.

5.2 Electromagnetic compatibility (EMC)

The equipment shall meet the requirements of IEC 60945.

5.3 Spurious emissions

The requirements set in ITU radio regulations appendix APS 3 shall apply.

5.4 Power supply

Equipment shall continue to operate in accordance with the requirements of this standard in the presence of variations of the power supply normally to be expected in a ship. (A.694/4.1)

5.5 Excessive conditions

Means shall be incorporated for the protection of equipment from the effects of excessive current and voltage, transients and accidental reversal of power supply polarity or phase sequence. (A.694/4.2)

5.6 Power supply interruption

(A.808/5.2) *Changing from one source of supply to another or any interruption up to 60 s of the supply of electrical energy shall not render the equipment inoperative or require the equipment to be manually re-initialized.*

Programmable functions stored in memory shall not be lost on power down and power up of the equipment.

6 Methods of testing and required test results

6.1 General

The requirements of this clause are in addition to the Inmarsat requirements for type approval, given in Inmarsat mini-M SDM Change Note 65. The manufacturer shall, unless otherwise agreed, set up the equipment and ensure it is operating normally before testing commences. If the test site used for type approval is also an accepted Inmarsat test facility, both series of tests may be combined, with the prior agreement of Inmarsat and the national test authority.

After successful completion of the Inmarsat Phase I tests (see Inmarsat mini-M SDM Change Note 65) compliance with the requirements of this Standard must be demonstrated by carrying out the tests described in the following clauses. These tests shall be conducted using a PLT (Physical Layer Test-set) or an alternative method of functionally achieving the same result.

The manufacturer shall state which items of equipment are classified as exposed and which are protected. The equipment normally protected by a radome shall be tested with the radome in situ under the "exposed" environmental conditions stated in IEC 60945

The manufacturer shall state what pre-conditioning is necessary before environmental testing, e.g. the activation of cooling fans in advance of testing.

6.1.1 Measurement uncertainties

Measurement uncertainty shall be calculated and techniques employed to minimise its range. This uncertainty shall be applied to the limit and any measurement falling below the range is deemed acceptable. [ISO 17025].

6.1.2 Performance testing

A performance check or test shall normally consist of telephony tests between the EUT and an Inmarsat Physical Layer Test-set

All tests shall be performed at a C/No of 48 dBHz ± 2 dB.

Verification of compliance with the technical requirements is provided by performance tests or performance checks at normal test conditions unless otherwise stated.

Ship's heading information may need to be provided, depending the design of the EUT, and manufacturers are advised to notify national administrations of their precise requirements in this regard well in advance of testing.

6.1.2.1 Performance check

In this standard, a "performance check" for the purpose defined in IEC 60945, shall comprise standard tests A and B, carried out for distress priority only.

6.1.2.2 Performance test

A "performance test" for the purpose defined in IEC 60945, shall comprise standard tests A and B, carried out for both distress and safety priorities.

6.1.3 Definition of standard tests

Standard tests comprise the setting up and clearing down of telephone calls with different priorities, with a subjective check of the circuit quality.

6.1.3.1 Standard test A: Duplex telephone test (ship originated)

The EUT operator shall set up a duplex telephone channel (4.8kbit/s) with the appropriate priority.

The EUT operator shall say clearly:

“This is the EUT operator performing test A, alpha. Please report my speech quality. Over”

The PLT operator shall reply:

“This is the PLT operator performing test A, alpha. Your speech quality is Good/Poor. Please report my speech quality. Over”

The EUT operator shall reply:

“Your speech quality is Good/Poor. I am now clearing the channel. Over”

The EUT operator shall clear the call.

6.1.3.2 Standard test B: duplex telephone test (shore originated)

The PLT operator shall set up a duplex telephone channel (4.8 kbit/s) with the appropriate priority.

The PLT operator shall say clearly:

“This is the PLT operator performing test B, bravo. Please report my speech quality. Over”

The EUT operator shall reply:

“This is the EUT operator performing test B, bravo. Your speech quality is good/poor. Please report my speech quality. Over”

The PLT operator shall reply:

“Your speech quality is good/poor. I am now clearing the channel. Over”

The PLT operator shall clear the call.

6.1.3.3 Results required

For the performance checks and tests in A and B for voice communication, calls shall be set up and cleared down satisfactorily. The correct priority shall be received at the PLT or the EUT as appropriate. Voice quality shall be good in both directions and it shall be possible to distinguish clearly the content of the voice messages.

6.1.4 Environmental testing

The EUT shall be tested for compliance with the environmental requirements set out in IMO resolution A.694(17), as detailed in IEC 60945 using the standard tests defined above before carrying out testing under ambient conditions.

6.1.5 Electromagnetic compatibility

The EUT shall be tested for compliance with the EMC requirements set out in IMO resolution A.694(17) as detailed in IEC 60945. For immunity tests, the method of demonstrating compliance with criterion “A”, “B” or “C” shall be by carrying out a performance check during or after each test, as appropriate.

6.1.6 Spurious emissions

Conformance to the current limits of ITU radio regulations appendix APS3 is covered by Inmarsat type approval. However, new limits are defined in APS3 as of 1st January 2003 and additional testing may then be necessary.

6.2 Test using local distress button

6.2.1 Purpose

This test checks the operation of the EUT when setting up a distress call using the local distress button and subsequently clearing it down by whatever means.

6.2.2 Method of test

See tests below for operational tests with and without pre-emption.

6.2.3 Results required

Results shall be in accordance with clause 6.1.3.3

6.3 Test using remote distress button

6.3.1 Purpose

This test checks the operation of the EUT when setting up a distress call using the remote distress button and subsequently clearing it down by whatever means.

6.3.2 Method of test

Test A shall be performed using distress priority, the call being set up using a remote distress button, located at least 10 m away from the EUT.

6.3.3 Results required

Results shall be in accordance with clause 6.1.3. 3

6.4 Operational tests (without pre-emption)

6.4.1 Purpose

These tests ensure that shore originated and ship originated calls can be set up with different priorities and subsequently cleared down. For a definition of these tests, please refer to the “Standard Tests” above.

6.4.2 Method of test

The following combination of standard tests and priorities shall be performed:

Table 1: Testing with Different Priorities

Test	Priority
Test A	distress priority (3)*
Test A	urgency priority (2)
Test A	safety priority (1)
Test A	routine priority (0)
Test B	distress priority (3)
Test B	urgency priority (2)
Test B	safety priority (1)
Test B	routine priority (0)
*This test call shall be set up using a "local" distress button designed to be co-located with the EUT.	

6.4.3 Results required

Results shall be in accordance with clause 6.1.3.3.

6.5 Operational tests (with pre-emption)

6.5.1 Purpose

These tests are to verify correct pre-emption of lower priority calls by calls of higher priority.

6.5.2 Method of test

Only pre-emption by ship originated calls is tested here. Pre-emption by shore-originated calls has been tested by Inmarsat during Inmarsat-F₇₇ infrastructure commissioning.

All priority 3 tests shall be set up from the local distress button.

- Duplex telephone calls shall be set up from the EUT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 2. Test A shall then be performed with all of the priorities (0, 1, 2, 3) shown in column 2, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- Duplex telephone calls shall be set up from the PLT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 3. Test A shall then be performed with all of the priorities (0, 1, 2, 3) shown in column 2, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- Duplex 2.4kb/s facsimile calls shall be set up from the EUT each with priority 0 (only priority available) as shown in column 1 of Table 4. Test A shall then be performed with all of the priorities (0, 1, 2, 3) shown in column 2, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- Duplex 2.4kb/s facsimile calls shall be set up from the PLT each with priority 0 (only priority available) as shown in Column 1 of Table 5. Test A shall then be performed with all of the priorities (0, 1, 2, 3) shown in column 2, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- Duplex 64kbit/s circuits shall be set up from the EUT (only priority 0 available). Test A shall then be performed with all the priorities (0,1,2,3) shown in column 2 of Table 6, without first clearing the original call in progress. The required outcomes are shown in Column 3.

- f) Duplex 64kbit/s circuits shall be set up from the PLT (only priority 0 available). Test A shall then be performed with all the priorities (0,1,2,3) shown in column 2 of Table 7, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- g) Duplex MPDS circuits shall be set up from the EUT (only priority 0 available). Test A shall then be performed with all the priorities (0,1,2,3) shown in column 2 of Table 8, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- h) Duplex MPDS circuits shall be set up from the PLT (only priority 0 available). Test A shall then be performed with all the priorities (0,1,2,3) shown in column 2 of Table 9, without first clearing the original call in progress. The required outcomes are shown in Column 3.
- i) Duplex telephone calls shall be set up from the EUT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 10. 2.4kbit/s fax calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.
- j) Duplex telephone calls shall be set up from the EUT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 10. 64kbit/s calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.
- k) Duplex telephone calls shall be set up from the EUT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 10. MPDS calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.
- l) Duplex telephone calls shall be set up from the PLT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 11. 2.4kbit/s fax calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.
- m) Duplex telephone calls shall be set up from the PLT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 11. 64kbit/s calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.
- n) Duplex telephone calls shall be set up from the PLT with each of the priorities (0, 1, 2, 3) shown in Column 1 of Table 11. MPDS calls shall then be attempted from the EUT (only priority 0 available) without first clearing the original call in progress. The required outcomes are shown in Column 3.

6.5.3 Results required

Telephone calls set up from the EUT shall automatically pre-empt on-going calls of a lower priority of any type, no matter whether set up originally from the EUT or from PLT. Pre-empted calls shall clear in accordance with normal clearing procedures and the higher priority telephone call shall then be set up automatically. Results shall be in accordance with clause 6.1.3.3. The tables below indicate the required test results for each of the sub-clauses a) to n) above.

Table 2: Pre-emption of telephone call set up from ship, by ship originated telephone call

Priority of original telephone call set up at ship.	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
1	0	No
1	1	No

1	2	Yes
1	3	Yes
2	0	No
2	1	No
2	2	No
2	3	Yes
3	0	No
3	1	No
3	2	No
3	3	No
NOTE: Inmarsat priorities are used		

Table 3: Pre-emption of telephone call set up from shore, by ship originated telephone call

Priority of telephone call set up from shore	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption Required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
1	0	No
1	1	No
1	2	Yes
1	3	Yes
2	0	No
2	1	No
2	2	No
2	3	Yes
3	0	No
3	1	No
3	2	No
3	3	Yes*
*A ship originated distress call shall take precedence over a shore-originated call with distress priority.		
NOTE: Inmarsat priorities are used		

Table 4: Pre-emption of 2.4kb/s facsimile call set up from ship, by ship originated telephone call

Priority of original facsimile call set up at ship.	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 5: Pre-emption of 2.4kb/s facsimile call set up from shore, by ship originated telephone call

Priority of original facsimile call set up from shore	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 6: Pre-emption of 64kbit/s call set up from ship, by ship originated telephone call

Priority of original 64kbit/s call set up at ship.	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 7: Pre-emption of 64kbit/s call set up from shore, by ship originated telephone call

Priority of 64kbit/s call set up from shore	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption Required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 8: Pre-emption of MPDS call set up from ship, by ship originated telephone call

Priority of original 64kbit/s call set up at ship.	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 9: Pre-emption of MPDS call set up from shore, by ship originated telephone call

Priority of 64kbit/s call set up from shore	Priority of subsequent telephone call set up from ship (from another authorised extension).	Pre-emption Required?
0	0	No
0	1	Yes
0	2	Yes
0	3	Yes
NOTE: Inmarsat priorities are used		

Table 10: Non-pre-emption of high priority ship originated telephone call by subsequent lower priority ship originated calls.

Priority of ongoing telephone call	Type of Subsequent Call (Priority 0)	Pre-emption Required?
0	2.4kbit/s fax	No
1	2.4kbit/s fax	No
2	2.4kbit/s fax	No
3	2.4kbit/s fax	No
0	64kbit/s	No
1	64kbit/s	No
2	64kbit/s	No
3	64kbit/s	No
0	MPDS	No
1	MPDS	No
2	MPDS	No
3	MPDS	No

Table 11: Non-pre-emption of high priority shore originated telephone call by subsequent lower priority ship originated calls.

Priority of ongoing telephone call	Type of Subsequent Call (Priority 0)	Pre-emption Required?
0	2.4kbit/s fax	No
1	2.4kbit/s fax	No
2	2.4kbit/s fax	No
3	2.4kbit/s fax	No
0	64kbit/s	No
1	64kbit/s	No
2	64kbit/s	No
3	64kbit/s	No
0	MPDS	No
1	MPDS	No
2	MPDS	No
3	MPDS	No

6.6 Power supply testing

6.6.1 Purpose

To test the EUT for compliance with the power supply requirements as set out in IMO resolution A.694(17) and detailed in IEC 60945 and the special requirements of this clause 6.6.

6.6.2 Method of test

The national administration shall agree this test with Inmarsat at least 7 days before the test is performed. Inmarsat will make arrangements with a cooperating RCC and advise the national administration of its identity and associated LES at least 24 hours before testing commences.

The EUT shall be set to acquire an Inmarsat satellite. The EUT shall then be subjected to the power supply interruptions described in IEC 60945. Unwanted transmissions from the antenna shall be detected by means of a test antenna located in an antenna sidelobe and a spectrum analyser or broadband power meter. Alternatively, a coupler in the feeder to the antenna of the EUT may be used to deliver power to the test equipment.

Three minutes after each power supply interruption, a ship originated priority 3 voice call shall be set up from the EUT to the cooperating RCC. At the end of each call, the call shall be cleared from the EUT.

6.6.3 Result required

During and after each power supply interruption, no unwanted transmissions shall be detected.

After each power supply interruption, there shall be no corruption of operational software and no essential data shall be lost.

The EUT shall recover after each power supply interruption in accordance with performance Criterion B of IEC 60945, within 3 minutes of power being restored.

Priority 3 test calls to the cooperating RCC shall be successful. Speech quality shall be good in both directions. Calls shall clear down successfully at the end of each call.

Annex A (Informative)

Requirements relating to installation.

The equipment manual should include all information necessary to determine whether the EUT complies with the IMO installation requirements.

A.1 Power supply

A.1.1 (A.808/A.5.1) *The ship earth station shall normally be powered from the ship's main source of electrical energy. In addition, it shall be possible to operate the ship earth station and all equipment necessary for its normal functioning, including the antenna tracking system, from an alternative source of energy.*

A.1.2 (A.808/A.5.2) *Changing from one source of supply to another or any interruption up to 60 s of the supply of electrical energy shall not render the equipment inoperative or require the equipment to be manually re-initialized.*

A.1.3 If provision is made for operating equipment from more than one source of electrical energy, arrangements for rapidly changing from one source to the other shall be provided but not necessarily incorporated in the equipment. (A.694/4.4)

A.2 Antenna siting

A.2.1 (A.808/A.6.1) *It is desirable that the antenna be sited in such a position that no obstacle likely to significantly degrade the performance of the equipment appear in any azimuth down to an angle of elevation of -5° .*

A.2.2 (A.808/A.6.2) *The siting of the antenna needs careful consideration, taking into account the adverse effect of high levels of vibration which might be introduced by the use of a tall mast and the need to minimize shadow sectors. Objects, especially those within 10 m of the radome which cause a shadow sector of greater than 6° , are likely to significantly degrade the performance of the equipment.*

A.2.3 (A.808/A.6.3) *The above deck equipment shall be separated, as far as is practicable, from the antennae of other communication and navigation equipment.*

Annex B (Informative)

Reception of maritime safety information (MSI)

MSI is broadcast currently by means of the NAVTEX and SafetyNET systems. Inmarsat-F₇₇ provides neither of these services. Reception of MSI is thus dependent on appropriate additional receiving equipment, e.g., a SafetyNET receiver, an Inmarsat-C transceiver capable of receiving SafetyNET transmissions or a NAVTEX receiver, being included in the GMDSS installation. (See IMO Resolution A.701(17), IEC 61097-4 and IEC 61097-6)

Annex C (Informative)

List of Inmarsat F₇₇ type approval tests

The following tests are performed during Inmarsat type approval. SES manufacturers are advised to make available Inmarsat type approval test results to national administrations on request.

1	Antenna gain
2	Antenna sidelobe determination
3	Antenna polarization & axial ratio
4	Antenna pointing error
5	Phase and amplitude jumps
6	Cable unwrap
7	G/T determination
8	Receiver tuning range
9	BPSK frame acquisition
10	BPSK BER
11	O-QPSK frame acquisition
12	O-QPSK BER
13	BPSK selectivity
14	O-QPSK selectivity
15	Dynamic range
16	O-QPSK C/No measurement at MES
17	Spot beam selection
18	16-QAM frame acquisition
19	16-QAM BER
20	16-QAM selectivity
21	16-QAM dynamic range
22	16-QAM C/No measurement and reporting
23	EIRP determination
24	Transmitter off level
25	Spurious and harmonics output
26	Transmitted phase noise
27	Transmitter tuning range
28	Transmitter frequency accuracy & stability
29	16-QAM EIRP determination
30	Power output monitor
31	Burst duration monitor
32	Transmitted frequency spectrum
33	Burst characteristics
34	Data clock accuracy
35	Transmitter performance degradation
36	16-QAM transmitted frequency spectrum
37	16-QAM modulation filtering
38	16-QAM group delay distortion
39	16-QAM relative phase and amplitude accuracy

40	16-QAM HPA linearity
41	16-QAM data clock accuracy
42	16-QAM transmitter performance degradation
43	Transmitter envelope and power control
44	16-QAM carrier activation
45	16-QAM channel format
46	Fail-safe
47	Facilities for testing
48	Electromagnetic compatibility
49	Physical characteristics
50	ACSE protocol tests
51	Audio tests
52	MESP transmitter analysis
53	MESP transmitter performance
54	LESP receiver performance
